

REVIEW ARTICLE

Herbal Medicines : A Review Of Advance Herbal Technology

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ABSTRACT

The popularity of herbal medicines has increased due to their numerous advantages. However, the lack of standardization and quality control presents a significant challenge to their reliable and safe use. Standardization is a vital process that ensures the consistency and effectiveness of herbal drugs. It involves the identification, quantification, and authentication of active constituents. To achieve standardization, a variety of analytical methods have been developed and utilized, ranging from traditional techniques to more advanced approaches. Traditional methods include macroscopic and microscopic evaluations, organoleptic examination, and physicochemical tests. These methods are valuable in identifying and characterizing the raw materials used in herbal formulations. Chemometrics, on the other hand, utilizes mathematical and statistical methods to analyze complex chemical data. This can aid in the identification and evaluation of active ingredients for herbal remedies. The standardization of herbal medicines is crucial for ensuring their safety, efficacy, and quality. Various analytical methods, both conventional and advanced, have been developed and employed to maintain the consistency and chemical profile of herbal medicines.

Keywords: Standardization, herbal drug, DNA fingerprinting, chromatographic techniques, Quality of herbal extract

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INTRODUCTION

Herbal medicine involves the utilization of plants or plant-derived substances for the treatment or prevention of illnesses. This practice has a rich historical background and remains prevalent in various cultures worldwide. Herbal medicine is an interdisciplinary field that integrates knowledge from diverse disciplines such as botany, pharmacology, chemistry, as well as traditional medicinal practices like Ayurveda and Unani medicine. This multidisciplinary approach enhances the understanding of the properties and mechanisms of action of different plants and their components. Herbalists are professionals who specialize in the application of herbs for therapeutic purposes, often formulating personalized herbal remedies based on their expertise in plant properties. Herbal journals serve as platforms for the dissemination of research and information pertaining to the use of plants in medicine, enabling scientists and practitioners to exchange their findings and insights on herbal medicine [1, 7].

Several Techniques for plant Identification [2-4]

1. An expert opinion is often considered It is the most genuine and exactly method of identifying plants or plant-based substances. This is because experts in the field have extensive knowledge and experience with the characteristics, properties, and uses of different plant species. They can use this knowledge to accurately identify plants or plant-based substances, even in cases where the specimens are damaged or incomplete .Expert determination often involves the use of treatments

such as monographs, revisions, and synopses, which are prepared by experts and provide detailed information on different plant species. This information can be used to accurately identify plant and distinguish between closely related species. However, the reliance on experts for identification can present some challenges. Experts may not always be available or may not have the time to devote to every identification request. This can create delays in the identification process, which can be problematic in situations where quick and accurate identification is critical [2].

2. Recognition is another method of plant identification that can be reliable and accurate, especially when the identifier has huge experience in the plant species group in question. This method relies on the identifier's past experience and knowledge of the characteristics and properties of different plant species. Overall, recognition can be a useful method of plant identification, particularly for experienced identifiers who have a deep understanding of the plant group in question. However, it is important to supplement this method with other approaches, such as expert determination, DNA analysis, or computer-based image recognition, to increase the reliability and accuracy of plant identification.
3. Comparison: comparison method involves comparing an uncertain specimen with named specimens, photographs, illustrations, or descriptions to identify the plant or plant-based substance. This method can be reliable and accurate, especially when high-quality materials are available for comparison. However, the comparison method can also be time-consuming and may not always be feasible. It requires access to a large collection of named specimens, photographs, illustrations, or descriptions, which may not always be available, particularly for rare or obscure plant species. In addition, the comparison method may be less reliable for individuals who are not familiar with the specific plant group in question, as it can be difficult to distinguish between closely related species based on visual characteristics alone. Regardless of these limitations, the comparison techniques can still be a useful tool in plant identification, particularly when used in combination with other approaches such as expert determination, DNA analysis, or computer-based image recognition. By combining different methods, it is possible to increase the reliability and accuracy of plant identification and overcome some of the limitations associated with each individual approach [3].
4. Keys and Similar Tools (Synopses , Outlines, etc.) using keys along with other related tools, such as synopses and outlines is a widely used method of plant identification that can be efficient and accessible. Keys are a set of dichotomous or multiple-choice questions that lead the user through a series of choices until the unknown plant is identified. Keys can be in the form of books, online resources, or mobile applications. Synopses and outlines are condensed versions of keys that provide a quick reference guide to identifying plants based on visual characteristics [4].

Recognition of plants: Herb authentication is a critical level assurance process in the production of herbal medicines. This verifies that the right plant species and plant parts are utilized as base materials. The use of incorrect or adulterated plant materials can have serious consequences on the effectiveness as well as safety of organic medicines, as well as on consumer trust in these products. Proper herb authentication involves the use of various techniques, including visual inspection, organoleptic analysis, microscopy, chemical analysis, and DNA sequencing. These methods can be used individually or in combination to accurately identify the plant species and plant parts used in herbal medicines. herb identification is a critical Quality assurance technique that is essential for the safety, efficacy, and regulatory compliance of herbal medicines. By ensuring herbal medicine employs suitable species of plants and plant parts as unprocessed components, manufacturers can ensure that their the highest levels of safety and quality are achieved by the products. macroscopic examination is a commonly used method in plant identification and involves the comparison of visible morphological characters with in floras or monographs, explanations of a plant or botanical drugs. This method is useful in identifying the external features of a plant or botanical drug, such as size, shape, color, and texture [5].

Macroscopic: examination is particularly useful in the identification of plant parts that are readily visible to the naked eye, such as leaves, flowers, and fruits. For example, the dimensions, form, and tone of leaves or leaf sections can be used to identify a plant species. Similarly, the color, size, and shape of flowers or fruits can be used to identify the plant or botanical drug .macroscopic examination is a useful method in plant identification that can provide valuable information about the external features of a plant or botanical drug. While it may not be sufficient on its own to identify a plant species, it can be a useful tool in combination with other methods such as microscopic examination, chemical analysis, or DNA sequencing. microscopic examination is a method of plant identification that involves the use of a microscope to study the anatomical structures of plant products constructed of materials that are invisible to the human sight. This method is particularly useful in identifying plant parts such as stems, roots, and seeds, which may not have readily visible morphological features [6].

Microscopic : examination involves the preparation of thin sections of plant material that can be observed under a microscope. The sections may be stained or treated with reagents to enhance the visibility of specific anatomical features. Common anatomical structures that are observed in microscopic examination include cell walls, cell types, trichomes, stomata, and vascular tissue. Microscopic examination is a valuable tool in plant identification and quality assurance. It can provide detailed information about the anatomical structures of plant materials, which can be used to accurately identify the species and confirm the purity and authenticity of herbal raw materials [7, 2, 4].

Chromatography: Chromatography is a process used to separate blend's constituents based on their chemical and physical properties. There are many chromatography techniques, including gas chromatography (GC), liquid chromatography (LC), and thin-layer chromatography (TLC), but they all follow the same basic principles. In chromatography, a mixture is introduced onto a phase that is stationary, typically a solid material or a solid base with a liquid covering. According to the chemical and physical properties of each component in the mixture, the stationary state reacts with all of them uniquely, such as its size, shape, polarity, or charge. As a result, the parts of the mixture are divided as they travel through the stationary phase. The separated components can be detected and analyzed using various processes, such as UV-visible spectroscopy, mass spectrometry, or flame ionization detection. The results of chromatography can provide valuable information about the identity, purity, and quantity of the components in the mixture. TLC, or thin-layer chromatography, is a widely utilized technique for herbal authentication and is widely used in the pharmaceutical industry for the quality control of herbal drugs. TLC involves spotting a small amount of the specimen onto a thin layer of an adsorbent material (which is frequently silica gel or alumina) set on a glass or plastic plate. After that, the plate is placed in an incubator with a suitable solvent or solvent mixture, which allows the compounds in the sample to separate based on their differential adsorption and solubility properties. As the solvent moves up the plate, the separated compounds will appear as individual spots, each with its own characteristic color and R_f (retention factor) value. The R_f value is the ratio between the distance that a compound goes from its point of origin and the length the solvent front travels from its origin. The separated compounds can then be visualized by spraying the plate with a suitable detection reagent or by exposing it to UV light [8]. The resulting pattern of spots on the TLC plate, or the so-called "fingerprint", can be compared to those of authentic samples or reference compounds to identify the presence or absence of specific compounds in the sample. (HPLC) is a powerful chromatographic technique that separates compounds based on their polarity and is frequently used while analyzing herbal compounds. Including the determination of active compounds, contaminants, and adulterants. Gas chromatography (GC) is used to separate volatile compounds and is commonly used in the analysis of essential oils and fatty acids [5, 6, 9].

A wide range of methods for extraction, including contemporary ones like Supercritical fluid:

Extraction is a method of isolating soluble elements from an insoluble residue, which can be either a liquid or a solid, using a liquid solvent. As a result, the process of resolving the issue is dependent on the mass transfer phenomena [10]. The extraction rate usually depends on how quickly the solute diffuses through the fluid's boundary layer at the interface.

The main techniques for extraction include as follows:

- **Maceration:** This involves soaking the material to be extracted for an amount of time with the aim to supply the desired compounds to dissolve.
- **Percolation:** This involves passing a solvent through a bed of the material to be extracted, allowing the solvent to extract the desired compounds as it passes through.
- **Soxhlet Extraction:** This involves repeated cycles of boiling and condensation of a solvent through the material being extracted in a special apparatus called a Soxhlet extractor.
- **Steam Distillation:** This involves passing steam through the material being extracted, allowing the volatile compounds to be carried along with the steam and then condensed to form an extract.
- **Supercritical Fluid Extraction (SFE):** This involves the use of supercritical fluids, such as CO₂, to extract the desired substances. The supercritical fluid has properties of both liquids and gases, enabling it to dissolve the desired compounds without damaging them.
- **Solvent Extraction:** For the purpose of to extract the intended chemicals from the substance being extracted, a solvent is used in this process. The desired chemicals' solubility and the properties of the material being extracted influence the solvent of choice. Solvent extraction is a widely used method in various industries for the separation and extraction of compounds. It is an essential method used in chemical laboratories, and separatory funnels can be utilized to finish it. Solvent extraction distinguishes substances according to how well they dissolve. Usually, water

and an organic solvent are two different liquids that cannot mix. This process is useful for focusing on or removing a specific drug or separating mixtures. It is employed in a number of businesses, including those that process ore, produce fine organic compounds, process fragrances, and process nuclear materials [11].

Supercritical fluid extraction (SFE): Is an advanced extraction technique that overcomes some of the limitations of traditional liquid extraction methods. SFE utilizes a supercritical fluid, typically CO₂, which is compacted to supercritical phase where it exhibits properties of both a liquid and a gas. In this state, it can penetrate and dissolve materials like a liquid solvent but can be easily separated from the extracted material like a gas. SFE is a rapid, efficient, and environmentally friendly extraction method that is particularly useful for extracting non-polar and semi-polar compounds. SFE is used regularly in the process of obtaining essential oils, flavors, fragrances, and other natural products, as well as in the pharmaceutical, cosmetic, and food industries [4].

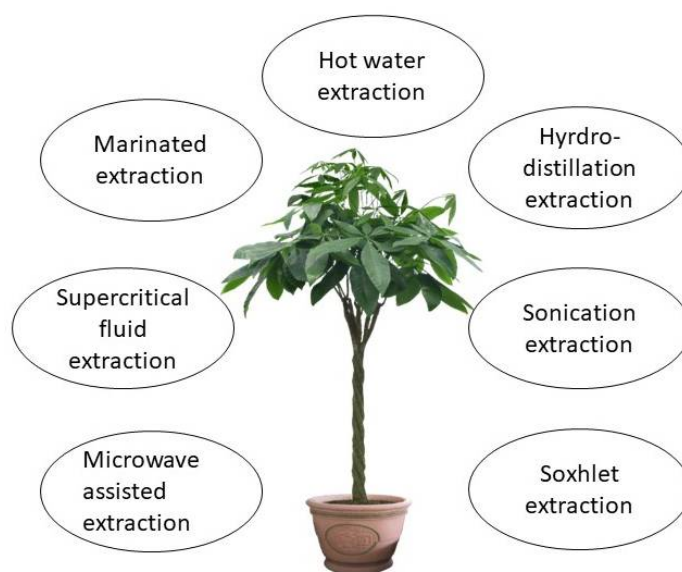


FIGURE NO. 1 : The 7 extraction methods described in the text.

HERBAL PROCESSING AND EXTRACTION METHOD

Microwave assisted extraction :

The fundamentals of microwave-aided extraction : A type of electromagnetic radiation is the microwave, which means they consist of waves of magnetic and electric fields oscillate perpendicular to each other and move at the speed of light through space They are inside the category of electromagnetic radiation, which also includes radio frequencies, X-rays, gamma rays, visible light, infrared light, and ultraviolet (UV) rays. Microwaves have a frequency range of 300 MHz to 300 GHz and a wavelength range of 1 cm to 1 m. They are used for various purposes, including communication (such as in microwave ovens), radar, and medical treatments .In microwave ovens, microwaves are used to meal by forcing the water molecules to expand. in the food to tremble and produce heat. The microwaves used in commercial microwaves have a frequency of 2450 MHz and are equivalent to about 600-700 watts of energy. This energy is absorbed by the food, which heats up quickly and evenly [13].

Ultrasound assisted extraction :Extraction is one of the oldest techniques used by humans to obtain desired compounds from natural sources. The process involves separating a specific component or substance from a mixture by using different methods such as distillation, filtration, and evaporation . As you mentioned, many ancient civilizations such as Jews, Arabs, Indians, Chinese, Greeks, Romans, Phoenicians, Egyptians, and Jews had advanced knowledge of extraction and distillation techniques. They used these techniques not only for the extraction of medicinal compounds but also for perfumes, cosmetics, and food .For example, the ancient Egyptians used essential oils extracted from plants in their religious rituals and for medicinal purposes. Extraction techniques are widely used in various industries, including food, pharmaceuticals, cosmetics, nutraceuticals, and bioenergy. These techniques are used to extract desired compounds from natural sources, such as plants and animals, to produce a wide range of products . Popular techniques include maceration, solvent extraction, steam or hydro-distillation, cold

pressing, squeezing, and more to extract bioactive compounds, flavors, fragrances, and other substances from plant and animal sources. These compounds are then used in various applications, such as food additives, pharmaceuticals, and cosmetic ingredients [14]. With the increasing concerns about energy costs and greenhouse gas emissions, many industries are looking for new extraction technologies that are more energy-efficient and environmentally friendly. For example, some companies are exploring the use of Energy consumption is reduced via extraction with supercritical fluid, which replaces carbon dioxide for organic solvents as a solvent. and emissions. energy costs and greenhouse gas emissions, many industries are looking for new extraction technologies that are more energy-efficient and environmentally friendly. For example, some companies are exploring the use of supercritical fluid extraction, which uses carbon dioxide as a solvent instead of organic solvents, to reduce energy consumption and emissions. The desire for developing new, improved ways of extraction that are automatable, such ultrasound-assisted extraction, has increased in recent years. This is driven by the need to overcome the limitations of traditional extraction techniques, such as long extraction times, high organic solvent consumption, and high energy costs. Ultrasound-assisted extraction is a non-thermal extraction technique that utilizes high-frequency sound waves to extract compounds from plant and animal sources. The technique has been shown to be effective in reducing extraction times, reducing solvent consumption, and improving extraction yields compared to traditional extraction methods. Innovative ultrasound-assisted In recent years, many extraction methods have been developed, including Continuous extraction of ultrasound-assist, ultrasound-assisted Soxhlet removal, ultrasound-assisted Clevenger distillation, and ultrasound in conjunction with other processes as a microwave, extrusion, and extraction of supercritical fluid ultrasound-assisted extraction and other innovative extraction techniques are becoming increasingly popular in various industries due to their ability to improve efficiency, reduce costs, and minimize environmental impact [15].

Importance of standardization : Standardization of Herbal Formulations : Standardization of herbal formulations is a crucial step in ensuring their safety, efficacy, and quality. Good Manufacturing Practices (GMP) should be implemented during the production methodology to guarantee the product's similarity and purity. In addition, various parameters such as pharmacodynamics (the study of the drug's effects on the body), pharmacokinetics (the study of absorption of drug's, distribution, metabolism, and excretion), dosage, stability, shelf-life, and toxicity evaluation should be considered to ensure the product's safety and efficacy. Chemical profiling of the herbal formulation is also essential to identify the active ingredients and ensure consistency in the product's composition. Other elements, including heavy metal pollution, pesticide residue, aflatoxin level, and good practices in farming (GAP), should also be considered to ensure the product's safety. herbal drug standardization requires a comprehensive approach that involves multiple factors, including GMP, hazard assessment, the dose, stability, shelf-life, pharmacodynamics, pharmacokinetics, and chemical profiles, pesticide residue, aflatoxin content, heavy metals contamination, and GAP. By considering all these factors, herbal drug standardization can ensure the efficacy, safety, and quality of herbal formulations [16].

DRUGS FOR ADVANCE TECHNOLOGY

1. **JASMINE (JASMINUM):** Jasmine can have various effects on the human body due to its interaction with the limbic system, which is responsible for regulating emotions, memories, and the autonomic nervous system. The scent of jasmine has been shown to have a calming effect and can help alleviate symptoms of anxiety and depression. In addition to its potential mental health benefits, jasmine has also been studied for its potential effects on physical health. For example, some research suggests that jasmine can help improve sleep quality and regulate hormones. Additionally, jasmine has antimicrobial properties that may help lower the risk of infections. While more research is needed to fully understand the potential health benefits of jasmine, incorporating it into your daily routine, whether through a plant or essential oil, may be a simple way to enhance your overall well-being. It's important to note, however, that essential oils should always be used with caution and diluted properly before use [17].

2. **SHANKPUSHPI (CONVOLVULUS PLURICAULIS) :** Shankpushpi is indeed a popular herb in Ayurveda, known for its beneficial effects on brain function and mental health. The plant is also known by its scientific name *Convolvulus pluricaulis*, and it belongs to the family *Convolvulaceae*. The active constituents of Shankpushpi are alkaloids, flavonoids, glycosides, and steroids. These bioactive compounds have discovered to have neuroprotective, antioxidant, and anti-inflammatory properties, which can improve brain health and function. Shankpushpi has been traditionally used assist with managing a range of cognitive and emotional issues, like memory loss, anxiety, depression, insomnia, and stress. It is believed to work by enhancing the levels of neurotransmitters like acetylcholine, gamma-aminobutyric acid (GABA), and serotonin, which play important roles in cognitive and emotional

processes. To use Shankhpushpi for its memory-boosting and brain tonic properties, you can take it in various forms, such as powder, tablets, capsules, or syrup. The recommended dosage and mode of administration may vary depending on the specific product and your individual needs. It is best to consult a qualified Ayurvedic practitioner or healthcare professional before starting any herbal supplement or remedy. In addition to taking Shankhpushpi, you can also adopt healthy lifestyle habits to promote optimal brain function, such as getting enough sleep, eating a balanced diet rich in nutrients, staying physically active, engaging in mental exercises, and managing stress levels [18].

CONCLUSION

In addition to regulatory measures, consumers should be well-informed about the efficacy and safety of natural therapies. It is advisable for them to consult qualified healthcare professionals and strictly adhere to the recommended usage of herbal medicines. With appropriate guidance and regulation, herbal remedies can continue to play a significant role in enhancing health and managing illnesses. Legislation should permit the proper utilization of herbs that have substantial scientific backing for their benefits. This can facilitate the utilization of these herbs for their potential health advantages, while ensuring their safe and effective use. To make well-founded decisions regarding herbal medicines, access to dependable information on their safety and effectiveness is crucial. Such information can be acquired through scientific investigations, such as clinical trials and systematic reviews of existing data. Once a sufficient body of scientific evidence is amassed, it can be utilized to educate individuals on the correct application of herbal therapies, encompassing dosages, contraindications, and potential adverse effects. These guidelines can be integrated into legislation to guarantee the safe and effective use of herbal medicines. Legislation should be grounded on the most reliable scientific evidence available and should be formulated to encourage the application of natural remedies for disease management and the enhancement of public health in a safe and effective manner.

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